RASBORA JOHANNAE (TELEOSTEI: CYPRINIDAE), A NEW SPECIES OF THE *R. TRIFASCIATA*-COMPLEX FROM KALIMANTAN, INDONESIA

by

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ABSTRACT. - *Rasbora johannae*, a new species of the *R. trifasciata*-complex is described from small forest streams deep within the Barito River basin, Kalimantan (Borneo), Indonesia. The new species possesses: a vivid dark lateral stripe terminating in an obvious precaudal blotch located largely behind the end of the hypural plate, and which covers the bases of the middle caudal fin rays; median fins with colourless interradial membranes; an incomplete lateral line (modal pored scale count 20); and a modal vertebrae count of 32. Discriminant functions analysis of quantitative data sets of morphometric, vertebral, and scalation variables demonstrate the new species is broadly different from other members of the *R. trifasciata*-complex from eastern Borneo. *Rasbora trifasciata, R. hubbsi, R. rutteni*, and *R. meinkeni* all possess a dark lateral stripe similar to that of the new species. It is suggested that these species are closely related among the *R. trifasciata* complex.

RÉSUMÉ. - *Rasbora johannae* est décrite des petits cours d'eau forestiers du haut bassin de la rivière Barito, Kalimantan (Bornéo), Indonésie. Cette nouvelle espèce présente les caractères suivants: une bande latérale noir vif se terminant en une tache précaudale nette, située bien en arrière de l'extrémité de la plaque hypurale et qui couvre la base des rayons médians de la nageoire caudale; les membranes interradiaires des nageoires impaires sont incolores; la ligne latérale est incomplète (nombre d'écailles avec pores: 20); le nombre modal de vertèbres est de 32. Des analyses discriminantes des données quantitatives portant sur la morphométrie et les nombres de vertèbres et d'écailles ont montré que la nouvelle espèce est bien différente des autres espèces du complexe *R. trifasciata* de la partie orientale de Bornéo. *Rasbora trifasciata, R. hubbsi, R. rutteni* et *R. meinkeni* possèdent toutes une bande latérale noire semblable à celle de la nouvelle espèce. Il est suggéré que ces espèces ont des affinités étroites au sein du complexe *R. trifasciata*.

Key-words. - Cyprinidae, *Rasbora johannae*, *R. trifasciata*-complex, Indonesia, New species, Taxonomy.

The genus *Rasbora* Bleeker, 1859 was last revised by Brittan (1954). The genus as construed by Brittan is now recognized as 'catch-all' (Kottelat and Vidthayanon, 1993) and based on subsequent anatomical studies Howes (1980) and Kottelat and Vidthayanon (1993) have elevated some groups to generic rank from within it. Nevertheless *Rasbora sensu lato* is still used as a convenient working assemblage for large comparative studies (Roberts, 1989; Kottelat and Vidthayanon, 1993). So construed (*sensu lato*), the genus occupies a huge geographic range including the subcontinent of India and eastward to southern China, south over western parts of the Philippines to include the Greater Sunda Islands of Indonesia, and even eastward to include Bali, Lombok, and Sumbawa (Brittan,

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1954). Much of this region remains unexplored ichthyologically and in recent years descriptions of new species of *Rasbora* have appeared at a steady rate as areas of its distribution have been collected. The eventual size of the genus may well be greater than 100 species.

Brittan recognized a subgroup within *Rasbora,* the *trifasciatae* (= *R. trifasciata*-complex), that is still recognized as a convenient working group (Kottelat and Vidthayanon, 1993). Small compressed species with a transverse scale count of 4½-1-3½, and with relatively fewer predorsal, lateral series and pored lateral series scales than in most other species of *Rasbora* are included in the *R. trifasciata*-complex. Members of the *R. trifasciata*-complex also are said to show a dark lateral stripe that is markedly less intense on the anterior half of the body.

A small elegant species of *Rasbora* exhibiting characteristics of members of the *R. trifasciata*-complex was collected from small forest streams flowing into Sungai Busang of the upper Barito River basin, Borneo during February, 1991. Examination of type material of *R. trifasciata* Popta, 1905, *R. hubbsi* Brittan, 1954, *R. rutteni* Weber & de Beaufort, 1916, *R. ennealepis* Roberts, 1989 and *R. bankanensis* (Bleeker, 1853), and series of *R. sarawakensis* Brittan, 1951 and *R. trifasciata* has convinced us it is not conspecific with any other member of the *R. trifasciata*-complex. The species is therefore described as new below.

MATERIALS AND METHODS

Methods

Color pattern terminology follows Brittan (1954), who described the dark lateral stripe as composed of four elements: axial streak; paraxial stripe; deep stripe; and superficial stripe. Brittan's conventions for scale counts and for carrying forward the dorsal-hypural distance are also followed, but his convention of categorizing the lateral line as complete even if it only extends to the end of the anal fin base is not. Vertebral counts follow Siebert (1991) except that dorsal and anal fin positions are counted as the vertebra on which a vertical line through their origin falls. Statistical analyses were performed with SYSTAT for DOS, version 6.0 (SPSS, Inc. 1994). Localities for comparative materials are reported as recorded on jar labels. Institutional abbreviations follow Leviton *et al.* (1985).

Comparative materials examined

Rasbora hubbsi. - CAS 117477, Holotype, Malaysia (Borneo), Sabah State, Lahad Datu River, J.A. Tubb, 7 Aug. 1949. CAS 115367, 10 spms, Malaysia (Borneo), Sabah State, Balung River near Tawan, A. Herre, 22-23 Jan. 1937.

Rasbora trifasciata. - RMNH 7623, 7 syntypes, Borneo, Mahakam River drainage, Sungai Bo, Dr. Nieuwenhuis, May 1900.

Rasbora cf. *bankanensis.* - BMNH 1995.5.3:92-186, 95 spms, Indonesia, Kalimantan Tengah, Barito River drainage, Sungai Murung, sand bars of Sungai Murung around Project Barito Ulu basecamp on Sungai Murung, seine, 12 Feb. 1991, D. Siebert, O. Crimmen, A.H. Tjakrawidjaja.

Rasbora rutteni. - CAS 115338, paratype, Borneo, "Sungi Wain", Dr. L. Rutten.

Rasbora sarawakensis. - BMNH 1982.3.29:98-101, 4 spms, Indonesia, Kalimantan Barat, Kapuas River basin, T. Roberts.

Fig. 1. - Holotype of *Rasbora johannae*, n. sp., MZB 6094, 38.1 mm SL, Barito River basin, Kalimantan Tengah, Indonesia; scale bar in mm.

Rasbora ennealepis. - BMNH 1982.3.29:81-82, 2 paratypes, Indonesia, Kalimantan Barat, Kapuas River basin, T. Roberts.

RASBORA JOHANNAE N. SP.

(Fig. 1, Tables I, II)

Type materials

Holotype. - MZB 6094, 38.1 mm SL, Indonesia, Kalimantan Tengah, Barito River drainage, Sungai Busang, small tributary of Sungai Busang upstream from Project Barito Ulu basecamp on Sungai Busang; rotenone; 1 Feb. 1991; D. Siebert, O. Crimmen, A.H. Tjakrawidjaja.

Paratypes. - BMNH 1995.5.3:20-66, 47 specimens 11.6-36.3 mm SL, collection data as for holotype.

Table I. - Selected mensural features as percentages of standard length of species of the *R. trifasciata*-complex from eastern Borneo. For each feature the mean ± its standard error is followed by the range, in parentheses, expressed as the minimum and maximum observation.

	R. johannae	*R. trifasciata*	*R. hubbsi*	*R.* cf. *bankanensis*
Head length	29.6 ± 0.14 (27.6 - 31.9)	28.4 ± 0.31 (27.4 - 29.4)	27.6 ± 0.33 (24.9 - 28.7)	26.3 ± 0.13 (25.1 - 27.2)
Eye length	10.2 ± 0.08 (8.5 - 11.4)	8.3 ± 0.24 (7.6 - 9.4)	8.9 ± 0.18 (7.9 - 10.1)	8.3 ± 0.12 (7.5 - 9.8)
Body depth	26.9 ± 0.18 (23.9 - 28.9)	26.7 ± 0.64 (24.2 - 29.6)	30.1 ± 0.44 (28.1 - 33.1)	25.9 ± 0.24 (23.2 - 28.1)
Predorsal length	55.5 ± 0.18 (52.9 - 58.5)	54.9 ± 0.47 (53.4 - 56.8)	54.6 ± 0.45 (51.4 - 57.1)	55.1 ± 0.23 (53.6 - 57.6)
Postdorsal length	49.0 ± 0.24 (46.1 - 52.8)	50.1 ± 0.31 (48.4 - 50.9)	50.8 ± 0.40 (48.3 - 52.8)	48.4 ± 0.35 (45.3 - 51.5)

Non-type materials

Rasbora johannae. - BMNH 1995.5.3:1-5, 5 spms, Indonesia, Kalimantan Tengah, Barito River drainage, Sungai Busang, small stream at Project Barito Ulu basecamp on Sungai Busang, rotenone, 30 Jan. 1991, D. Siebert, O. Crimmen, A.H. Tjakrawidjaja. BMNH 1995.5.3:6-19, 14 spms, Indonesia, Kalimantan Tengah, Barito River drainage, Sungai Rekut (a tributary of Sungai Busang) upstream from Project Barito Ulu basecamp on Sungai Busang, rotenone, 31 Jan. 1991, D. Siebert, O. Crimmen, A.H. Tjakrawidjaja. BMNH 1995.5.3.67-91, 25 spms, Indonesia, Kalimantan Tengah, Barito River drainage, Sungai Busang, small tributary of Sungai Busang downstream from Project Barito Ulu basecamp on Sungai Busang, rotenone, 2 Feb. 1991, D. Siebert, O. Crimmen, A.H. Tjakrawidjaja.

Diagnosis

Rasbora johannae can be distinguished from all other members of the *R. trifasciata*-complex by the following combination of characters. It is a species of the *R. trifasciata*-complex of Brittan (1954) with a prominent dark lateral stripe terminating in a round spot that covers the bases of the middle caudal fin rays; interradial membranes of

Table II. - Counts of meristic features of species of the *R. trifasciata*-complex of eastern Borneo. For scale, vertebrae and rib counts, and dorsal and anal fin position, the mean ± its standard error is followed by the range in parentheses, expressed as the minimum and maximum observation. Sample size, in square brackets, follows the range. The count of the lateral series is of pored scales and includes scales on the caudal fin base, except for *R. johannae* n. sp. where it is the count of scales along the normal path of the lateral line. Vertebral counts follow Siebert (1991) except as explained in the text. For gill rakers upper and lower limb minima and maxima are followed by frequency of total count. [1] Number of pored scales equal to number of scales in the lateral series. [2] Data from Roberts (1989).

	R. johannae	*R. trifasciata*	*R. hubbsi*	*R. cf. bankanensis*	*R. rutteni*
Scales in lateral series	24.5 ± 0.24 (19 - 26) [33]	26.6 ± 0.34 (25 - 28) [7]	25.1 ± 0.23 (24 - 26) [10]	25.6 ± 0.17 (24 - 27) [20]	26
Pored scales in lateral series	18.8 ± 0.44 (14 - 23) [31]	[1]	[1]	[1]	[1]
Circumpeduncular scales	11.9 ± 0.04 (11 - 12) [33]	12 ± 0.0 (12 - 12) [7]	13.8 ± 0.18 (12 - 14) [11]	12 ± 0.0 (12 - 12) [19]	12
Predorsal scales	10.9 ± 0.06 (10 - 12) [35]	12 ± 0.0 (12 - 12) [7]	10.6 ± 0.14 (10 - 11) [7]	10.9 ± 0.11 (10 - 12) [20]	10
Vertebrae	32.1 ± 0.07 (32 - 33) [19]	34.6 ± 0.20 (34 - 35) [7]	34.0 ± 0.15 (33 - 35) [10]	33.9 ± 0.09 (33 - 35) [20]	33
Abdominal vertebrae	14.9 ± 0.05 (14 - 15) [19]	16.0 ± 0.22 (15 - 17) [7]	15.9 ± 0.10 (15 - 16) [10]	15.5 ± 0.12 (15 - 16) [20]	15
Caudal vertebrae	17.2 ± 0.09 (17 - 18) [19]	18.6 ± 0.20 (18 - 19) [7]	18.1 ± 0.09 (18 - 19) [11]	18.4 ± 0.14 (18 - 20) [20]	18
Peduncular vertebrae	9.2 ± 0.09 (9 - 10) [19]	10.0 ± 0.22 (9 - 11) [7]	9.3 ± 0.14 (9 - 10) [11]	7.9 ± 0.05 (7 - 8) [20]	9
Ribs	10.0 ± 0.0 (10 - 10) [19]	11.7 ± 0.18 (11 - 12) [7]	10.9 ± 0.10 (10 - 11) [10]	11.3 ± 0.10 (11 - 12) [20]	10
Dorsal fin position	9.4 ± 0.12 (9 - 10) [19]	10.3 ± 0.18 (10 - 11) [7]	9.9 ± 0.10 (9 - 10) [10]	11.0 ± 0.05 (11 - 12) [20]	9
Anal fin position	14.7 ± 0.11 (14 - 15) [19]	16.0 ± 0.0 (16 - 16) [7]	16.6 ± 0.22 (15 - 17) [10]	17.0 ± 0.07 (16 - 18) [20]	16
Gill rakers	2 + 5 - 7 = 7(1), 8(10), 9(1)	2 + 6 - 7 = 8(1), 9(4)	[2]2 - 3 + 8 - 10 = 10(5), 12(2)	1 - 2 + 8 - 9 = 9(11), 10(3), 11(1)	[2]1 + 7 = 8

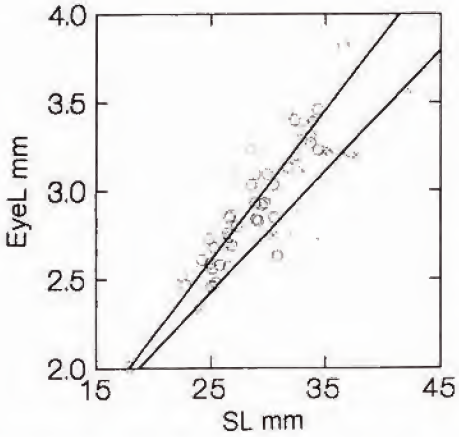


Fig. 2. - Eye length (EYEL) plotted against standard length (SL) for *Rasbora johannae*, n. sp. (○), ($y = 0.485 + 0.085x$; $r = 0.827$; slope significantly different from 0 ($p < 0.001$)) and *R. hubbsi* Brittan, 1954 (×) ($y = 0.722 + 0.068x$; $r = 0.744$); slope significantly different from 0 ($p = 0.001$)). The two slopes are significantly different from each other (2-tail *t*-test; $p < 0.001$).

dorsal and anal fins hyaline; lateral line incomplete, count of pored scales modally 20 (14-23), count of scales in the lateral series modally 25 (19-26), circumpeduncular scales rows modally 12 (11-12), predorsal scales modally 11 (10-12); vertebral number modally 32 (32-33), dorsal-hypural distance usually falling on the anterior margin of eye, sometimes near the center of eye.

Description

Rasbora johannae appears to be a relatively small species of *Rasbora*; the largest specimen captured is only 38.1 mm standard length. An angular dorsal profile, a smoothly curved ventral profile and obvious lateral compression create the impression of an elegant, graceful fish (Fig. 1).

In lateral view the predorsal profile ascends in a straight line from the snout to a region slightly in advance of the dorsal fin, about at a vertical through the insertion of the pelvic fins. In the largest specimens the mid-predorsal region is slightly concave. The dorsal profile descends from the dorsal fin origin to the top of the caudal fin base in a straight line.

The ventral profile is a relatively deep smooth curve from the chin to the posterior end of the anal fin base. It is straight from the end of the anal fin base to the caudal fin.

The head is relatively long with a comparatively large eye (Table I; Fig. 2).

The lateral line is incomplete with the number of pored scales in the lateral series highly variable. The number of pored scales in the lateral series (mean = 18.8, SE = 0.44; Table II) is far less than the total count (mean = 24.5, SE = 0.24); pored scales rarely extend beyond the posterior end of the anal fin base.

Vertebrae counts average 32.1 (SE = 0.07), with more caudal than abdominal vertebrae (Table II).

Specimens fixed in formalin have the upper half of the body dusky with fine puncta on exposed surfaces of scales. The belly is immaculate. The reticulate pattern is weakly developed, being most prominent in the midbody area where the posterior edges of scales are marked in black. The nape is marked by a single row of melanophores that follow the course of the supraoccipital laterosensory canal. A dark band two or three melanophores wide extends from this occipital line downward to the opercular opening, and then around it to about the level of the pectoral fin. The chin is marked with a weak

longitudinal bar. Fins are hyaline. Fin bases of freshly preserved specimens were a pale lemon yellow color.

A prominent dark lateral stripe is present from the operculum to the caudal fin. Two elements of the dark lateral stripe, the axial streak and the superficial stripe, are present universally among the present samples.

The superficial stripe is vivid on the posterior half of the body, only diffuse to faint on the anterior half of the body and often fades out entirely posterior to the hind edge of the operculum. It terminates in an obvious precaudal spot that is positioned largely posterior to the hypural plate. The posterior edge of the spot is extended over the bases of the middle caudal fin rays. The precaudal spot is about the same diameter as the pupil of the eye. The lateral stripe is only a little wider than half pupillary width.

The axial streak is present from the margin of the operculum to the caudal base. It borders the dorsal edge of the superficial lateral stripe on the posterior half of the body, but is narrowly divergent from it dorsally on the anterior half of the body.

An intense dark stripe marks the supra-anal and a weak subpeduncular streak is present, confluent with the supra-anal stripe. The juncture between the anal fin ray and hypaxial musculature is unmarked.

A dorsal stripe is present, but not strong, and is only a little wider than the bases of the anterior dorsal fin rays.

Etymology

Rasbora johannae is named in memory of Dame Joan Vickers, a long-time advocate of Indonesian culture.

Habitat notes

Rasbora johannae was collected by qualitative sampling methods from small high gradient forest streams tributary to Sungai Busang, Kalimantan Tengah, Indonesia in February, during the first of the two annual low rainfall periods. The streams all were very shaded, had very little or no emergent aquatic vegetation, had gravel to cobble bottoms, contained clear white water, and were never more than 5 m in depth and 3 m in width. Streams of similar size but with less gradient, sandy or muddy bottoms, or dark red water never yielded *R. johannae*, nor was it ever collected from larger streams and rivers of the area that were sampled. Its most common co-inhabitants were the balitorid *Nemacheilus spiniferus* Kottelat, 1984 and the cyprinid *Puntius binotatus* (Valenciennes, 1842).

Comparisons

Rasbora johannae is unlikely to be confused with most other species of *Rasbora* from the Barito River basin. However other species of the *R. trifasciata*-complex of similar appearance do occur in eastern Borneo. Direct comparisons with these species are made below and features pertinent to distinguishing *R. johannae* from these species are summarized in table III.

Rasbora trifasciata. - Although similar in color pattern, *R. trifasciata* is easily distinguished from *R. johannae* by its shape. The predorsal profile of *R. johannae* is straight to slightly concave. The predorsal profile of *R. trifasciata* has a distinct hump at the nape (clearly illustrated in Kottelat *et al.*, 1993; Plate 20), rendering its predorsal profile convex. *Rasbora johannae* also has fewer pored scales in the lateral series (mean = 18.8, SE = 0.44; mean = 26.6, SE = 0.34 for *R. trifasciata;* Table II), fewer vertebrae (mean = 32.1, SE = 0.07; mean = 34.6, SE = 0.20 for *R. trifasciata*; Ta-

ble II), and fewer gill rakers on the first arch (frequency of total count 7(1),8(10),9(1); 8(1), 9(4) for *R. trifasciata*; Table II).

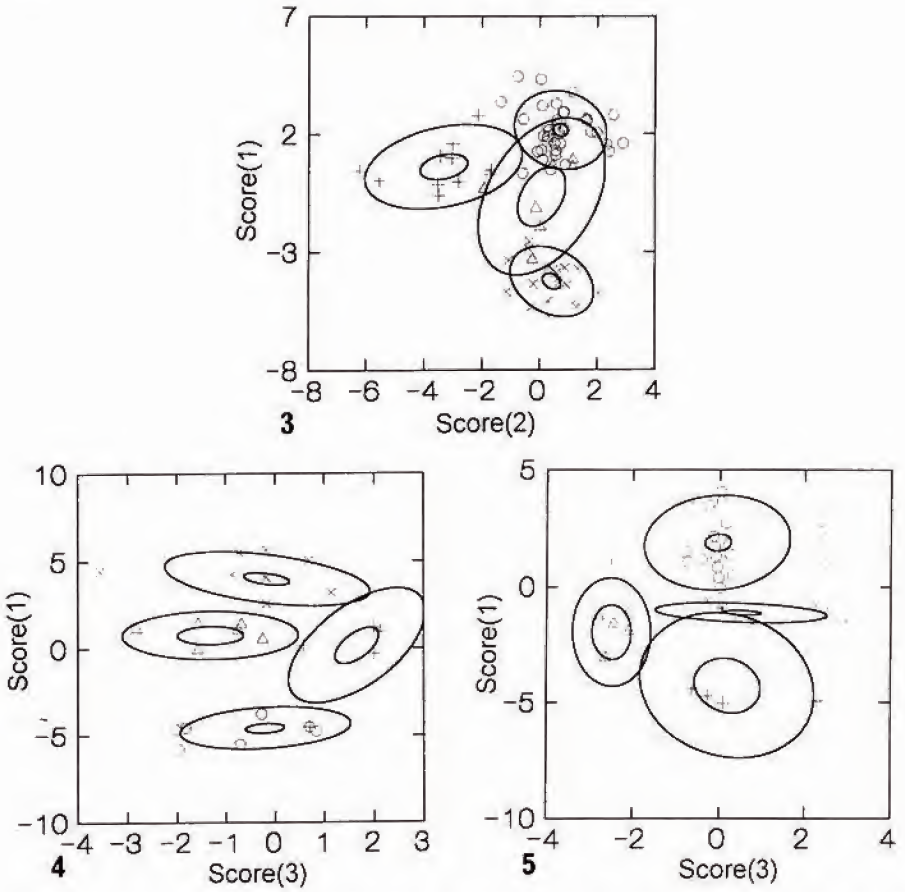
Rasbora hubbsi. - *Rasbora johannae* and *R. hubbsi* (illustrated in Brittan, 1954; Fig. 21) are very similar in appearance but on close inspection are easily separable. *Rasbora johannae* has a discernibly larger eye than *R. hubbsi* (Table I; Fig. 2) and the dorsal-hypural distance of *R. hubbsi* falls at the snout, or beyond, when carried forward, instead of at the anterior margin of the eye, or behind. *Rasbora johannae* has fewer pored lateral series scales (mean = 25.1, SE = 0.23 for *R. hubbsi*; Table II), fewer scale rows around the peduncle (12 peduncular scale rows; 14 peduncular scale rows in *R. hubbsi;* Table II; Inger and Chin (1962) report *R. hubbsi* specimens occasionally with 12), 2 fewer vertebrae (mean = 34.0, SE = 0.15 in *R. hubbsi;* Table II), and fewer gill rakers on the first arch (frequency of total count 10(5),12(2) for *R. hubbsi*; Roberts, 1989; Table II).

Rasbora rutteni. - *Rasbora johannae* is also similar in appearance to *R. rutteni*. A paratype of *R. rutteni* possesses 33 vertebrae (Table II) and Kottelat and Vidthayanon (1993) report 4 of 6 specimens in their sample also with 33 vertebrae. Inger and Chin (1962) report their material of *R. rutteni* lacks a subpeduncular streak, which *R. johannae* possesses.

Rasbora cf. *bankanensis*. - An undescribed species of *Rasbora* with a color pattern similar to *R. bankanensis*, except it lacks a large anal fin blotch, co-occurs with *R. johannae* in the Barito River basin. It possesses a dark streak on the first principle ray of the anal fin (lacking in *R. johannae*) and the posterior half of its axial streak is embedded within a much broader superficial lateral stripe (the axial streak forms the dorsal border of the superficial stripe on the posterior half of the body in *R. johannae*). In addition *R.* cf. *bankanensis* lacks the precaudal blotch found in *R. johannae*. *Rasbora* cf. *bankanensis* also possesses more pored lateral series scales (mean = 25.6, SE = 0.17; Table II) and 2 more vertebrae (mean = 33.9, SE = 0.09; Table II) than *R. johannae*.

Table III. - Summary of features by which *Rasbora johannae* n. sp. can be distinguished from other species of the *R. trifasciata*-complex of eastern Borneo. The mean is reported for counts of vertebrae and pored lateral series scales. Frequency of total counts are reported for gill rakers. [1] '+' = precaudal spot covering bases of middle caudal fin rays; '-' = precaudal spot absent. [2] Position at which the dorsal-hypural distance falls when carried forward. [3] Includes data from Kottelat and Vidthayanon (1993). [4] Data from Roberts (1989).

	R. johannae	*R. trifasciata*	*R. hubbsi*	*R. rutteni*	*R.* cf. *bankanensis*
Vertebrae	32.1	34.6	34.0	32.7 [3]	33.9
Pored lateral series scales	18.8	26.6	25.1	26	25.6
Predorsal profile	straigth / concave	hump at nape	straight	hump at nape	convex
Peduncular scale rows	12	12	14	12	12
Precaudal spot [1]	+	+	+	+	-
Dorsal-hypural distance [2]	front of eye	front of eye	tip of snout	front of eye	front 1/2 of eye
Gill rakers	7(1), 8(10), 9(1)	8(1), 9(4)	[4] 10(5), 12(2)	[4] 8(1)	9(11), 10(3), 11(1)



○ = *R. johannae* n. sp., × = *R.* cf. *bankanensis* (Bleeker, 1853), + = *R. hubbsi* Brittan, 1954, Δ = *R. trifasciata* (Popta, 1905).

Fig. 3. - Discriminant functions analysis of the natural logarithms of the morphometric variables reported in table I. The sample ellipse (outer) and centroid confidence interval (p = 0.75; inner ellipse) is shown for each centroid. Axes I and II account for 94.1% of total dispersion; Wilk's $\lambda = 0.0242$, df = 5 3 72, F = 35.7421, $p < 0.0001$. Standardized axes are: I = 2.169 body depth + 0.191 eye length + 2.741 head length - 1.742 postdorsal length - 3.788 predorsal length; II = 3.666 body depth - 0.322 eye length - 2.298 head length + 0.779 postdorsal length - 1.684 predorsal length.

Fig. 4. - Discriminant functions analysis of the scalation variables reported in table II. The sample ellipse (outer) and centroid confidence interval (p = 0.75; inner ellipse) is shown for each centroid. Axes I and III account for 72.9% of total dispersion; Wilk's $\lambda = 0.0371$, df = 4 3 57, F = 29.4747, $p < 0.0001$. Standardized axes are: I = 0.100 lateral series scales - 0.621 circumpeduncular scales - 0.815 pored scales in lateral series + 0.083 predorsal scales; III = 0.282 lateral series - 0.053 circumpeduncular scales + 0.056 pored scales in lateral series - 0.990 predorsal scales.

Fig. 5. - Discriminant functions analysis of vertebral, dorsal and anal fin position, and rib variables reported in table II. The sample ellipse (outer) and centroid confidence interval (p = 0.75; inner ellipse) is shown for each centroid. Axes I and III account for 79.2% of total dispersion; Wilk's $\lambda = 0.0077$, df = 6 3 52. F = 33.8610, $p < 0.0001$. Standardized axes are: I = 0.262 abdominal vertebrae + 0.734 caudal vertebrae - 0.487 peduncular vertebrae + 0.357 ribs + 0.384 dorsal fin position + 0.353 anal fin position; III = 0.542 abdominal vertebrae - 0.003 caudal vertebrae - 0.050 peduncular vertebrae - 0.712 ribs - 0.437 dorsal fin position - 0.698 anal fin position.

DISCUSSION

Rasbora johannae differs from other species of the *R. trifasciata*-complex of eastern Borneo in many dimensions of morphological character space. Comparisons among them based on multivariate analyses of the quantitative data sets are summarized graphically in figures 3-5. The collective dimensionality of the differences suggests underlying genetic differences of a broad nature. There can be little doubt that *Rasbora johannae* is different from other species of the *R. trifasciata*-complex at the species level.

Most members of the *R. trifasciata*-complex have equal numbers of abdominal and caudal vertebrae, or more caudal than abdominal vertebrae, a relatively rare occurrence among species of *Rasbora* (Kottelat and Vidthayanon, 1993). The abdominal to caudal vertebrae ratio can be added to Brittan's (1954) list of features said to characterize the *R. trifasciata*-complex. Traditional diagnoses such as this one for the *trifasciata* complex have sometimes been shown to contain evidence of a natural (monophyletic) grouping but some others have been shown to suffer the limitations of symplesiomorphy (paraphyly and polyphyly). The monophyly of the *R. trifasciata*-complex is therefore open to question, the resolution of which is beyond the scope intended here. However, within the *R. trifasciata*-complex *R. trifasciata, R. hubbsi, R. rutteni, R. meinkeni* and *R. johannae* have a remarkably similar dark lateral stripe, one aspect of which includes a precaudal blotch covering the bases of the middle caudal fin rays. This color pattern is distinctive and unusual among species of *Rasbora*, and thus is most likely derived. It therefore forms the basis of a hypothesis that *R. trifasciata, R. hubbsi, R. rutteni, R. meinkeni* and *R. johannae* are closely related among the *R. trifasciata*-complex. Brittan (1954) noted this similarity of color pattern in his comparison of the color patterns of *R. hubbsi* and *R. rutteni* and suggested a close relationship between them. This hypothesis expands that suggestion to include other *R. trifasciata*-complex members with a color pattern similar to theirs.

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